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Sandvik 12R11

(Strip steel)

Sandvik 12R11 is an austenitic stainless, general purpose steel with good spring properties that in most cases fulfil demands regarding corrosion resistance, mechanical strength, fatigue and relaxation properties.

Service temperature: up to 250°C (480°F)

STANDARDS

- ASTM (301)
- EN number 1.4310
- EN name X 10 CrNi 18-8
- SS 2331

CHEMICAL COMPOSITION (NOMINAL) %

C	Si	Mn	P max.	S max.	Cr	Ni	Mo	Others
0.10	1.2	1.3	0.030	0.010	16.5	7	-	-

FORMS OF SUPPLY

Sandvik 12R11 is supplied, as standard, in the cold rolled condition. Strip steel can be supplied in coils, bundles, on plastic spools or in lengths. The edges can be either slit, deburred or smoothly rounded. Contact us for more information.

Dimensions

The following range of thicknesses and widths can be supplied as standard. Please contact Sandvik if other dimensions are required.

Thickness, mm	Width, mm	Thickness, in.	Width, in.
0.015 - 3.00*	2 - 345	0.0006 - 0.118	.079 - 13.6

* Depending on requested tensile strength.

Tolerances

The thickness and width tolerances are +/- tolerances to the nominal size. The normal tolerance classes for most of our strip products are T2 and B1. Tighter tolerances as well as other tolerance limits can be offered upon request.

Stock standard

The following combinations of tensile strength and thickness are available from stock. Other combinations can be supplied on request.

Condition*	Tensile strength, R_m		Thickness
	MPa	ksi	mm
C	1300	189	0.20/0.30/0.40/0.50/0.60/0.80/0.90/1.00
C	1500	218	0.10/0.15/0.20/0.25/0.30/0.40/0.50/0.60/0.70/ 0.80/1.00/1.5/2.0
C	1700	247	0.10/0.15/0.20/0.30/0.40/0.50/0.60/0.90/1.00

* C = Cold rolled

MECHANICAL PROPERTIES

Static strength

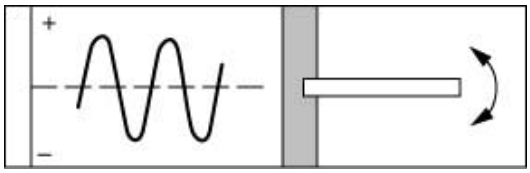
NOMINAL VALUES AT 20°C (68°F)

Condition[1)]	Tensile strength, R_m		Proof strength, $R_{p0,2}$[a)]		Elongation, $A_{11,3}$
	MPa	ksi	MPa	ksi	%
A	850	116	300	44	50
C	1300	189	1150	167	15
CT	1350	196	-	-	-
C	1500	218	1375	199	8
CT	1580	229	-	-	-
C	1700	247	1625	236	1.5
CT	1800	261	-	-	-
C	1900	276	1825	265	1
CT	2000	290	-	-	-

1) A = Annealed, C = Cold rolled, CT = Cold rolled and tempered, 350°C (662°F)/3 h. See further under section 'Heat treatment'.
a) $R_{p0.2}$corresponds to 0.2% offset yield strength.
1 MPa = 1 N/mm^2

Fatigue strength
Nominal values at 20°C (68°F) in a normal dry atmosphere. The fatigue limit is defined as the stress at which 50% of the specimens withstand a minimum of 2 million load cycles.

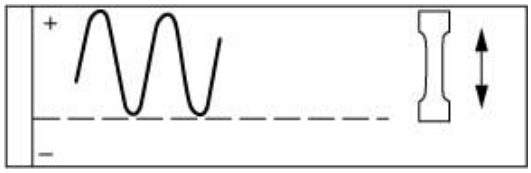
Reversed bending stress
Average stress = 0
Bending transversal to rolling direction.



Comparision made for different thicknesses and tensile strength levels.

Tensile strength, Rm	Fatigue strength		Tensile strength, Rm	Fatigue strength	
	Thickness, mm			Thickness, in.	
	0.50	0.75		0.020	0.030
MPa	MPa	MPa	ksi	ksi	ksi
1500	± 555	± 525	218	± 80.5	± 76.2
1700	± 560	± 545	247	± 81.3	± 79.1
1900	± 570	± 560	276	± 82.7	± 81.3
2000	± 600	± 580	290	± 87.1	± 84.2

Fluctuating tensile stress
Minimum stress = 0
Specimens parallel to rolling direction.



Comparision made for different thicknesses and tensile strength levels.

Tensile strength, Rm	Fatigue strength		Tensile strength, Rm	Fatigue strength	
	Thickness, mm			Thickness, in.	
	0.25	0.50		0.010	0.020
MPa	MPa	MPa	ksi	ksi	ksi
1500	420 ± 420	405 ± 405	218	60.9 ± 60.9	58.8 ± 58.8
1700	460 ± 460	425 ± 425	247	66.8 ± 66.8	61.7 ± 61.7
1900	475 ± 475	445 ± 445	276	68.9 ± 68.9	64.6 ± 64.6
2000	480 ± 480	460 ± 460	290	69.7 ± 69.7	66.8 ± 66.8

PHYSICAL PROPERTIES

The physical properties of a steel relate to a number of factors, including alloying elements, heat treatment and manufacturing route, but the following data can generally be used for rough calculations. These values refer to cold rolled material, at a temperature of 20°C (68°F) unless otherwise stated.

Density 7.9 g/cm^3 (0.29 lb/in)

Resistivity 0.8 mWm (31.5 mWin.)

Modulus of elasticity
'as delivered': approx 185 000 MPa (26 825 ksi)
tempered: approx 190 000 MPa (27 550 ksi)

Shear modulus
'as delivered': approx 70 000 MPa (10 150 ksi)

Specific heat capacity 500 J/kg°C (in the temperature range 50-100°C (120- 210 °F)

THERMAL EXPANSION MEAN VALUES IN TEMPERATURE RANGES (X10^{-6})

Temperature, °C	per °C	Temperature, °F	per °F
20 - 100 °C	15.5	68 - 200	8.5
20 - 200 °C	16	68 - 400	9
20 - 300 °C	16.5	68 - 550	9

THERMAL CONDUCTIVITY

Temperature, °C	W/m °C	Temperature, °F	Btu/ft h °F
20	15	68	8.5
100	16	200	9
300	19	600	11

CORROSION RESISTANCE

It is very important to avoid corrosion in spring applications so as not to impair spring properties. Sandvik 12R11 is an austenitic stainless steel and has sufficient corrosion resistance in most spring applications. The corrosion resistance is almost the same as ASTM 304 and, compared to other low alloyed spring steels, Sandvik 12R11 has superior performance. However, all austenitic steels of this type are susceptible to stress corrosion cracking (SCC) when in contact with chloride solutions at elevated temperatures.

HEAT TREATMENT

The strength of cold rolled Sandvik 12R11 can be increased by a tempering operation at 350°C (662°F) for 3 hours. An increase in tensile strength up to approx. 150 MPa (22 ksi) can be expected, depending on the initial cold rolled tensile strength. Further information on the nominal tempering effect can be seen under the "Mechanical properties" section. This heat treatment is also beneficial for relaxation and fatigue resistance.

Tempering is normally carried out by the customer after forming. To avoid discolouration, parts should be carefully cleaned before heat treatment. Tempering in open air furnaces gives a harmless brownish oxide on the surface.

WELDING

Sandvik 12R11, like most austenitic stainless steels, has a good weldability. Welding, however, introduces excess heat into the material closest to the weld that breaks down the structure formed by cold working. As a consequence, this will decrease the mechanical properties of the welded area. The lowest practical heat input, <1.0 kJ/mm, and interpass temperature for multipass welding, <100°C (210 °F), is recommended.

In most cases, the TIG (GTAW) method is preferable. It can be used either autogenously (without filler metal) or with filler metal. In both cases, pure argon (99.99%) should be used as the shielding gas.

When filler metal is used, Sandvik 19.9.L or Sandvik 19.9.LSi is recommended.

Due to the high carbon content of Sandvik 12R11, there is also a risk of carbide precipitation at the grain boundaries of the material in the heat affected zone (HAZ), which may decrease the corrosion resistance of the material in certain environments.

BENDING

The values given below have been obtained by bending according to Swedish standard SS 11 26 26 method 3 (in a 90° V-block with a 25 mm die opening, a sample of 35 mm width, turned so that the burrs of the blanked edges face into the bend). They can be used as guidance for the smallest recommended bending radius.

Nominal tensile strength, Rm	Thickness (t)	Min. bending radius as function of thickness*	
MPa	mm	⊥	//
1300	0.25	0.5 t	1 t
1300	0.50	0.5 t	2.5 t
1300	0.75	1 t	3 t
1300	1.0	1 t	3.5 t
1500	0.25	1 t	3.5 t
1500	0.50	1 t	5 t
1500	0.75	1.5 t	5.5 t
1500	1.0	2 t	6 t
1700	0.25	1.5 t	6.5 t
1700	0.50	2 t	9 t
1700	0.75	2.5 t	9.5 t
1700	1.0	3 t	9.5 t
1900	0.25	2 t	10 t
1900	0.50	3.5 t	11 t
1900	0.75	5 t	12 t

*) ⊥ Bend transverse to the rolling direction
// Bend parallel to the rolling direction

APPLICATIONS

Sandvik 12R11 is suitable for springs and other high strength components in the mechanical, electronics and computer industries. It is a very good spring material that in most cases fulfils demands regarding corrosion resistance, mechanical strength, fatigue and relaxation properties.

DISCLAIMER:
Recommendations are for guidance only, and the suitability of a material for a specific application can be confirmed only when we know the actual service conditions. Continuous development may necessitate changes in technical data without notice. This datasheet is only valid for Sandvik materials.